NASA SCIENCE MISSION DIRECTORATE

Earth-Sun System Applied Sciences Program
Aviation Program Element
FY 2005-2009 Plan

Version 1.1

March 16, 2005

Expanding and accelerating the realization of economic and societal benefits from Earth-Sun System science, information, and technology

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NASA Science Mission Directorate
Earth-Sun System Division
Applied Sciences Program

Applied Sciences for the Aviation Program Element

This document contains the Aviation Program Element Plan for Fiscal Years 2005-2009. This plan derives from direction established in the NASA Strategic Plan, the Earth Science Enterprise Strategy, the Space Science Enterprise Strategy, the Earth Science Applications Plan, and OMB/OSTP guidance on research and development. The plan aligns with and serves the commitments established in the NASA Integrated Budget and Performance Document.

The program manager and the Applied Sciences Program leadership have reviewed the plan and agree that the plan appropriately reflects the goals, objectives, and activities for the program element to serve the Applied Sciences Program, the Earth-Sun System Division, NASA, the administration, and society.

(Signature on file) February 11, 2005
John A. Haynes Date
Program Manager, Aviation
Applied Sciences Program
NASA Earth-Sun System Division

(Signature on file) February 11, 2005
Lawrence Friedl Date
Lead, National Applications
Applied Sciences Program
NASA Earth-Sun System Division

(Signature on file) February 11, 2005
Ronald J. Birk Date
Director, Applied Sciences Program
NASA Earth-Sun System Division

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NASA Earth-Sun System Division: Applied Sciences Program
Aviation

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Aviation Program Element Plan: FY 2005 - 2009

I. Purpose and Scope

This plan articulates the goals and direction of the Aviation Program Element for the period from Fiscal Year (FY) 2005 to 2009 by detailing the purpose of the program and our strategy to fulfill the Aviation mission with the resources available. The plan describes the Program's scope, including NASA's role in partnerships, the focus on decision support tools, and the types of science research results we seek to extend. Within the Earth-Sun System Division, this plan functions as a program management tool, describing the program structure, functional mechanisms, performance measures, and general principles that the Aviation activity will follow. The plan includes projects in which science research results can be applied to decision making with related socioeconomic benefits.

The Aviation Program Element is one of twelve Elements in the Science Mission Directorate's Applied Sciences Program. NASA and the Applied Sciences Program collaborate with partner organizations to enable and enhance the application of NASA's Earth-Sun system science research results to serve national priority policy and management decision support tools. The desired outcome is for partner organizations to use project results, such as prototypes and benchmark reports, to enable expanded use of Earth-Sun system science products and enhance decision support capabilities.

This Element focuses on the infusion of quality science observations from NASA Earth-Sun system spacecraft missions and predictions from Earth-Sun system science models into Aviation Decision Support Systems (DSS) managed by partner agencies and organizations. As the input to these DSSs becomes more comprehensive and accurate, the decisions made using these systems increase in accuracy and utility. More accurate DSSs lead to improvements in the aviation industry with regard to safety, security, efficiency, and environmental impacts. Weather plays a major role in each of these areas. Weather is a contributing factor in approximately thirty percent of all aviation accidents. Weather forecast models are currently initialized by hourly observations taken at many ground stations, but precise observations of the atmosphere above the ground are sparse and infrequent. Accurate upper air data, from NASA research spacecraft with improved temporal and spatial coverage, is beneficial to aviation meteorologists.

The purpose of the Aviation Program Element is to extend NASA Earth-Sun system spacecraft observations and Earth-Sun system science models to support the benchmarking of frequent, densely distributed Earth-Sun system science observations to support the National Airspace System (NAS) and address safety, capacity, security, and environmental issues. Observations from spacecraft such as TRMM, QuikSCAT, Terra, Aqua, and Aura support this purpose. Observations from future research missions such as NPP have the potential to add even greater value.

Impacts of weather upon aviation can be substantially mitigated using existing spacecraft weather information. At present, only a small percentage of the available spacecraft

observations are used in operational weather forecasting. NASA and its partners are working to bridge the gap between research results and operational solutions that assimilate information obtained by Earth observation satellites. NASA and its partners are working to make sure that information available from instruments on current and future spacecraft research missions are verified and validated for infusion into operational forecasting techniques in a more timely fashion. To this end, the Aviation program element partners with the NASA Aeronautics Research Mission Directorate as well as several Federal organizations, including the Federal Aviation Administration (FAA), the Office of the Federal Coordinator for Meteorology (OFCM), and the National Oceanic and Atmospheric Administration (NOAA). To address aviation issues, the Science Mission Directorate partnership with the Aeronautics Research Mission Directorate currently includes the Aviation Safety and Security Program (AvSSP) and will continue into the Phase II AvSSP that is planned to run from FY06 through FY10. More broadly, however, the Science Mission Directorate is coordinating with the recently established Joint Planning and Development Office (JPDO) consisting of the Departments of Transportation, Commerce, Defense, Homeland Security, NASA, and the Office of Science and Technology Policy (OSTP). The purpose of the JPDO is to transform the National Airspace System to improve its capacity and safety as required through the year 2025. The JPDO strategy was delivered to Congress as the "Next Generation Air Transportation System Integrated Plan" in December 2004.

NASA's science activities are international in scope with participation by the European Space Agency, France, Canada, Japan, Russia, Brazil, The Netherlands, and Finland. NASA works collaboratively with national and international scientists, including the World Weather Research Program (WWRP) of the World Meteorological Organization (WMO) and with the National Resource Council of Canada through Meteorological Services Canada. NASA is also an active participant in the THORPEX international meteorological campaign coordinated through the WMO. Activities are also coordinated with members of the U.S. Weather Research Program (USWRP).

A major thrust of the NASA Aviation Program Element is the Advanced Satellite Aviation-weather Products (ASAP) activity (co-funded with NASA Aeronautics Research Mission Directorate). ASAP is a major component of AvSSP. This initiative began in 2002 and its objectives are:

1) to fill a critical gap in the integration of current Geostationary Operational Environmental Satellite (GOES) imagery and sounding observations in the production of operational aviation weather products (produced by the NOAA National Weather Service) that are developed by the FAA Aviation Weather Research Program (AWRP);
2) to bridge the gap between developing aviation weather products using current Earth observation satellite imagery and sounding data and integrating next generation hyperspectral spacecraft observations of the atmosphere into aviation weather product development.

ASAP verifies and validates data obtained by the NPOESS Airborne Sounder Test-bed (NAST) and Scanning Hyperspectral Infrared Sounder (S-HIS) instruments, the Airborne Infrared Sounder (AIRS), the Cross-track Infrared Sounder (CrIS) as well as Polar and Geostationary

Orbiting Environmental Satellites (POES and GOES), the Aqua Earth Observation spacecraft and the AURA atmospheric chemistry spacecraft. The goal of these ASAP efforts is to support FAA AWRP Product Development for ground and airborne product production and to conduct applications product demonstrations.

Scope within NASA and Applied Sciences Program

The Aviation Program Element is managed in accordance with, and is guided by, the NASA Strategic Plan and Earth Science Enterprise Strategy. The program element benefits from Earth-Sun system science results and capabilities including Operation System Simulation Experiments (OSSEs), Project Columbia, the Joint Center for Satellite Data Assimilation (JCSDA), the Earth-Sun System Gateway (ESG), and the Transition from Research to Operations (R2O). The program element utilizes initiatives such as the Global Information Grid (GIG) and Federal Enterprise Architecture (FEA) and cooperates with national Earth-Sun laboratories and international programs.

The FY05 President's Budget for the NASA Applied Sciences Program* specifies $54M annually for FY05-FY09 for the National Applications ($24M) and Crosscutting Solutions ($30M) activities. While directly managing a subset of the $24M National Applications budget, the Aviation Program Element (and each of the national applications) benefits from the performance results of the $30M budget for Crosscutting Solutions (see Crosscutting Solutions Program Element Plan). The Aviation Program Element leverages and extends research results from the approximately $2.1B per year supporting Earth-Sun system science research and development of innovative aerospace science and technology.

Additional information about the NASA Applied Sciences Program can be found at http://science.hq.nasa.gov/earth-sun/applications.

** The National Applications and Crosscutting Solutions components of the Earth Science Applications Theme in the NASA FY05 Integrated Budget & Performance Document*

ASAP plans primarily focus on In-flight Icing and Oceanic Weather in FY05. In conjunction with the FAA AWRP's In-flight Icing PDT, ASAP plans to begin the integration of ASAP cloud microphysical properties and derived icing algorithms to be benchmarked in early FY05 into the National Weather Service (NWS) Current Icing Potential product. Oceanic weather activities in FY05 focus on collaboration with the FAA AWRP's Oceanic Weather Product Development Team and the NASA AvSSP's Aviation Weather Information (AWIN) Project to develop prototype oceanic convective weather, turbulence, wind and volcanic ash products for the FY05 AWIN flight evaluation with United Airlines employing AWIN displays of ASAP enhanced AWRP products over Pacific Ocean routes. The objective of this exercise is the validation of AWIN cockpit display systems using FAA AWRP graphical product prototypes that will eventually be provided operationally by the NWS Aviation Weather Center (AWC) in the same manner that they currently are provided by CONUS. This is a particular opportunity to accelerate the development of greatly needed oceanic weather hazard avoidance products that must be

developed largely using spacecraft observations due to the remote nature of the operating areas and the lack of traditional surface-based observations such as radar and station reports. The further development and validation of these oceanic products is planned during phase II of the AVSSP.

During FY05 the Program Element began to support the observation and decision support system requirements outlined in the National Aviation Weather Strategy developed by the interagency JPDO. This includes support for the development of an Aviation Weather Digital Database that underpins the National Airspace System. Earth-Sun system science research activities focus on integrating current ASAP activities with FAA and NOAA efforts in support of the JPDO.

II. Goals and Objectives

The goal of the Applied Sciences Aviation Program Element is to enable beneficial use of Earth-Sun system science observations, models, and technologies to enhance decision support capabilities serving aviation management and policy responsibilities.

The Integrated System Solution diagram (Appendix A) illustrates the extension of Earth science measurements, model products, and data fusion techniques to support NASA's partners' DSTs and the value and benefits of applied Earth-Sun science to society.

Listed below are both short and long-term objectives of the program with their appropriate linkage to the FY 05 NASA Integrated Budget and Performance Document (IBPD) and the NASA Strategic Plan.

	NASA Strategic Plan Goal 2.1, IBPD Outcome 1.2.1. 1.2.2, and 1.2.3
FY05	September 2005 -- In-Flight icing Expert System integration into the NOAA/NCEP/AWC Current Icing Product (CIP)
	September 2005 -- *Potential* Oceanic Convective Weather Tool benchmark (5ESA2, 6, 7)
	September 2005 -- *Potential* Volcanic Ash Detection and Tracking Tools benchmark (5ESA2, 6, 7)
	September 2005 -- In-flight icing benchmark report (5ESA2, 6, 7)
	Year-long development:
	Develop oceanic turbulence algorithms and integration of Earth-Sun system observations/model predictions for the FAA AWRP for development of NOAA/NCEP/AWC products.

	Develop oceanic wind algorithms and integration of Earth-Sun system observations/model predictions for the FAA AWRP for development of NOAA/NCEP/AWC products. Develop oceanic convective weather algorithms and integration of Earth-Sun system observations/model predictions for the FAA AWRP for development of NOAA/NCEP/AWC products. Develop volcanic ash algorithms and integration of Earth-Sun system observations/model predictions for the FAA AWRP for development of integrated volcanic ash tools for NOAA/NCEP/AWC. Coordinate with the interagency JPDO and begin development of Aviation Weather Digital Database with FAA and NOAA/NCEP *NASA Strategic Plan Goal 2.2* Aviation emissions project with Air Quality Program Element, if appropriate
FY06	*NASA Strategic Plan Goal 2.1, IBPD Outcome 1.2.1, 1.2.2, 1.2.3* Benchmark Earth Science Modeling Framework predictions into NAS – potentially in the area of oceanic weather (FY06 IBPD metric) Evaluate potential of NPP observations to serve the NAS (FY06 IBPD metric) Turbulence algorithm validation/integration into NOAA/NCEP/AWC products Oceanic (volcanic ash) algorithm validation/integration into NOAA/NCEP/AWC products. Transition ASAP research to the Weather Information System Enhancements (WISE) project of the Aviation Safety and Security Program. . Integration of ASAP and Airborne remote sensing research conducted by the Weather Information Next-Generations Sensors (WINGS) element of the Weather Information System Enhancements (WISE) project of the Aviation Safety and Security Program if appropriate. *NASA Strategic Plan Goal 2.2* Aviation emissions project with the Air Quality Program Element, if appropriate

	NASA Strategic Plan Goal 2.1, IBPD Outcome 1.2.1 and 3.1.3
FY07-09	Development of Aviation Weather Digital Database and evaluation of WISE project. *NASA Strategic Plan Goal 2.2* Aviation emissions project with the Air Quality Program Element, if appropriate

III. Program Management and Partners

Program Management

Program Manager Aviation Program Element
John A. Haynes
Applied Sciences Program
Science Mission Directorate
NASA Headquarters
Responsibilities:

- Program Element development, strategy, plans, and budgets
- Program representation and advocacy of issues to Science Mission Directorate management and beyond
- Communication of Science Mission Directorate priorities and directives to Aviation application team/network
- Implementation of interagency agreements and partnerships
- Monitoring Aviation application metrics and performance evaluation
- Being cognizant of and meeting IBPD and PART responsibilities and requirements
- Oversight of HQ funded grants

Deputy Program Manager Aviation Program Element
John J. Murray
Chemistry and Dynamics Branch
Science Directorate
NASA Langley Research Center
Responsibilities:

- Management of ASAP
- Co-chair, Observations Working Group, Interagency JPDO Aviation Weather IPT
- Leadership on project plans, development, performance, and partner relationships
- Communication of project metrics, performance, status, and issues to Program Manager
- Leadership and communications to Aviation application team and network
- Coordination between NASA Centers on Aviation Program Element activities
- Management of Aviation grants, contracts, and cooperative agreements funded by/through LaRC.

NASA Partners

NASA Aeronautics Research Mission Directorate
Associate Administrator……Dr. J. Victor Lebacqz
JPDO Principal……..Terrence Hertz
JPDO Aviation Weather IPT Representative….Ron Colantonio

NASA Science Mission Directorate, Earth-Sun System Div., Flight Missions Program
Director…….....Charles Gay

NASA Science Mission Directorate, Business Management Division
Program Analyst……....Joan Haas

NASA Science Mission Directorate, Earth-Sun System Div., Research Program
Weather Theme Lead…….Tsengdar Lee
Atmospheric Composition Theme Lead…….Phil DeCola
Earth Surface and Interior Lead……...John LeBrecque

NASA Ames Research Center (ARC)
Program Manager……Steve Hipskind

NASA Marshall Space Flight Center (MSFC)
SPoRT Laboratory Director…….Steve Goodman

NASA Glenn Research Center (GRC)
Aerospace Engineer…….Mary Wadel

The Aviation Program Element is also establishing working relationships with the NASA Distributed Active Archive Centers (DAACs) including the following:

- Goddard Earth Sciences DAAC (GSFC)
- Global Hydrology Resource Center (MSFC)
- Langley Atmospheric Sciences Data Center (LaRC)

The Aviation Program Element is also establishing working relationships with several Earth-Sun System science laboratories, including the following:

- Laboratory for Atmospheres (NASA/GSFC)
- Global Hydrology and Climate Center (NASA/MSFC)
- Short Term Prediction Research and Transition Center (NASA/MSFC)
- NOAA Office of Research and Applications
- NOAA National Centers for Environmental Prediction
- NASA/NOAA Joint Center for Satellite Data Assimilation
- National Center for Atmospheric Research

The Aviation Program Element had minimal connections to CCSP/CCTP in FY04. The program element is exploring connections between aviation and climate change in FY05 in several areas,

including aerosols and stratospheric ozone. This work is coordinated with the Interagency Working Group for Earth Observations (IWGEO).

External Federal, State, and Academic Partners and Points of Contact

Detailed information on these partners and their roles can be found in Appendix C.

FAA Aviation Weather Research Program: http://www1.faa.gov/aua/awr
AWRP Team Leader ……Gloria Kulesa

Office of the Federal Coordinator for Meteorology (OFCM): http://www.ofcm.gov
Senior Staff Physical Scientist……...Mary Cairns

FAA Operations
Member Manager……....Rick Heuwinkel (FAA ARW-100)
Specialist……..Steve Albersheim (FAA ARW-100)

NOAA/NWS Office of Science and Technology: http://www.nws.noaa.gov/ost
Coordinator of Aviation Weather Services……Mark Andrews
Aviation Meteorologist……..Kevin Johnston

NOAA/NWS NCEP Aviation Weather Center (AWC): http://aviationweather.gov
Director……..Jack May
Science and Operations Officer……Fred Mosher

FAA Technical Center
Aviation Weather Research Lead……..Danny Sims

NOAA National Environmental Satellite Data Information Service (NESDIS)
Senior Meterologist……Grace Swanson

NOAA/University of Wisconsin Cooperative Institute for Meteorological Satellite Studies (CIMSS)
Director……..Dr. Steven Ackerman
ASAP Manager……Wayne Feltz

NOAA Forecast Systems Laboratory (FSL)
Branch Chief……...Dr. Stan Benjamin

Joint Planning and Development Office (JPDO): http://www.jpdo.aero
Chair: Norman Mineta, Secretary of U.S. Department of Transportation
Principals:
……. Mark Andrews, DoC
……...Terry Hertz, NASA
……....Jack Howell, FAA
……..Carl McCullough, DOD

……...Jon Montgomery, DoC
……..…..Marty Phillips, OSTP
……...Paul Polski, DHS

National Center for Atmospheric Research (NCAR)
Research Applications Program (RAP)
Manager of Engineering……....Bruce Carmichael
Project Scientist…….David Johnson

MIT Lincoln Laboratory (LL)
Co-chair, JPDO Observations Working Group….Dr. Mark Weber

National Institute of Aerospace (NIA)
Lead……...Dr. Bill Grose

United States Weather Research Program (USWRP)
Lead Scientist……Dr. Bob Gall

Aerospace States Association (ASA)
……Lt. Gov. Mary Fallin (Oklahoma)

Western Governors Association (WGA)
……Gov. Bill Richardson (New Mexico)

National States Geographic Information Council (NSGIC)
President……....William F. Johnson

GLOBE
Principal Investigator (Contrails)……...Lin Chambers

International Partners and Points of Contact

Radio Technical Commission for Aeronautics (RTCA)
Chairman……Robert Blouin

International Civil Aviation Organization (ICAO)
Secretary General……...Taieb Cherif

National Research Council (NRC) Canada, Meteorological Service Canada (MSC), and the Canadian Weather Research Program (CWRP)
Director (CWRP)…….Dr. Jim Abraham
Senior Scientist……Dr. George Isaac

IV. Decision Support Tools and Aviation Issues

National Airspace System (NAS):

The National Airspace System (NAS) has many components and is a complex collection of systems, procedures, facilities, aircraft, and, of course, people. The mission of the NAS is to assure the safe and efficient movement of aircraft through the nation's airspace. The NAS, as directed by the FAA, represents the overall environment for the safe operation of aircraft. This environment includes the aircraft itself, the pilots, the facilities, the tower controllers, the terminal area controllers, the enroute controllers, and the oceanic controllers. This environment also includes the airports, the maintenance personnel and the airline dispatchers. All of this, including computers, communications equipment, spacecraft navigation aids, and radars, are a part of the NAS.

Last year, within the NAS there were 640 million emplanements. This number could reach one billion within the next five to ten years. The Aviation Program Element focuses on four elements of the NAS:

(1) FAA AWRP Nowcasting Products/AWC ADDS

The Aviation Digital Data Service (ADDS) makes available to the aviation community text, digital and graphical forecasts, analyses, and observations of aviation-related weather variables. ADDS components are developed by the FAA AWRP and put into operational use by NOAA/NCEP/AWC. Components of ADDS include the Current Icing Potential (CIP), Forecast Icing Potential (FIP), the National Convective Weather Forecast (NCWF), and the Graphical Turbulence Guidance (GTG). These products are crucial in decision-making on efficiency and safety issues for commercial and general aviation.

Aviation Digital Data Service (ADDS): http://adds.aviationweather.noaa.gov/

Current Icing Potential (CIP): http://aviationweather.gov/exp/cip/

Forecast Icing Potential (FIP): http://sentinel.aviationweather.gov/icing/

National Convective Weather Forecast (NCWF):
http://adds.aviationweather.gov/convection/

Graphical Turbulence Guidance (GTG): http://adds.aviationweather.gov/turbulence/

(2) Numerical Aviation Weather Models

The overall goal of the Weather Research and Forecast (WRF) Model project is to develop a next-generation mesoscale forecast model and assimilation system that will advance both the understanding and prediction of important mesoscale precipitation systems, and promote closer ties between the research and operational forecasting communities. The model is being developed as a collaborative effort among several government sponsored institutions (including the US Air Force, NOAA/FSL, and NOAA/NCEP), together with the participation of a number of university scientists.

The WRF will provide improved mesoscale, short-term forecasts that will benefit both the commercial and general aviation community.

Weather Research and Forecast Model (WRF): http://wrf.fsl.noaa.gov/

The Rapid Update Cycle (RUC) is a NOAA operational weather prediction system comprised primarily of a numerical forecast model and an analysis system to initialize that model. The RUC was developed to serve users needing frequently updated short-range weather forecasts, including those in the US aviation community.

Rapid Update Cycle Model (RUC): http://maps.fsl.noaa.gov/

(3) NOAA Volcanic Ash Advisory Center VAFTAD Model

The Volcanic Ash Forecast Transport and Dispersion (VAFTAD) Model is a graphical forecast tool produced by NCEP which is used by the Volcanic Ash Advisory Center (VAAC) in Washington to construct Volcanic Ash Advisories (VAA). The VAFTAD model is supplemented by observations from Earth-Sun system science spacecraft, such as TOMS and the MODIS instruments onboard Aqua and Terra. Commercial airlines and the air traffic management community use VAAs to avoid risks posed by volcanic effluent.

http://www.ssd.noaa.gov/VAAC/vaftad.html

(4) National Airspace System Air Traffic Management Tools

NASA/ARC develops Decision Support Tools for arrival, surface, and departure operations, and flight deck tools to support the FAA Free Flight Program. This Program also assures interoperability of tools internally and with the National Airspace System before transfer to the FAA for NAS implementation.
http://www.asc.nasa.gov/aatt/dst.html

V. Applications Activities:

A. Projects

<table>
<tr><th colspan="6">Project: Advanced Satellite Aviation-weather Products (ASAP)</th></tr>
<tr><td colspan="4" rowspan="2">ASAP began in 2002 and its objectives are 1) to fill a critical gap in the integration of current Geostationary Operational Environmental Satellite GOES imagery and sounding data in the production of operational aviation weather products (produced by the National Weather Service) that are developed by the FAA Aviation Weather Research Program (AWRP) and 2) to bridge the gap between developing aviation weather products using current spacecraft imagery and sounding data to integrating the next generation of high-resolution, hyperspectral spacecraft observations into aviation weather product development.</td><td colspan="2">Budget</td></tr>
<tr><td>FY05</td><td>700K</td></tr>
<tr><td>Project Manager</td><td>Centers</td><td>Timeframe</td><td>Partners</td><td>FY06</td><td>435</td></tr>
<tr><td rowspan="3">John Murray--LaRC</td><td rowspan="3">LaRC (lead), GRC, ARC, MSFC</td><td rowspan="3">FY05-FY09</td><td rowspan="3">FAA, NOAA</td><td>FY07</td><td>335</td></tr>
<tr><td>FY08</td><td>175</td></tr>
<tr><td>FY09</td><td>175</td></tr>
<tr><td>Earth Science Products</td><td colspan="3">ASAP uses Earth-Sun science products from a number of spacecraft including GOES, POES, Terra (MODIS), Aqua (MODIS), TOMS, QuikScat (SeaWinds), and TRMM. Data are also used from international spacecraft such as METEOSAT (ESA) and GMS (Japan).

The FAA AWRP funds basic research among its five Product Development Teams (PDTs). ASAP funds its own researchers to develop observation algorithms from observations and integrate those algorithms into operational products run by NOAA. The goal of this work is the evaluation, validation, integration, and benchmarking of these observations and algorithms for the improvement of NOAA operational aviation products in the areas of in-flight icing, oceanic weather, turbulence, ceiling and visibility, and convective weather.</td><td colspan="2">Other Apps.</td></tr>
<tr><td>Additional Information/Deliverables</td><td colspan="3">The five FAA Product Development Teams (PDTs) and scientific leads are listed below:
• In-Flight Icing --Marcia Politovich, NCAR
• Oceanic Weather--Tenny Lindholm, NCAR
• Turbulence--Bob Sharman, NCAR
• Convective Weather--Marilyn Wolfson, MIT/LL

In FY05, ASAP plans to integrate the NASA spacecraft icing risk product and cloud microphysics into the FAA Current Icing Potential Product (CIP), as well as produce an in-flight icing benchmark report. The development and benchmarking of convective initiation fields for the FAA Oceanic Convective Weather Forecast product, as well as volcanic ash tools, will occur in FY05. Additional information on deliverables can be found in Section II.</td><td colspan="2">N / A</td></tr>
<tr><td colspan="6"></td></tr>
</table>

Project: Aviation Weather Digital Database (AWDD)					
The AWDD is slated to begin development in FY05. The AWDD will combine Eart-Sun system observations and model predictions into a 5-D precise, continuously updating short-term model of the atmosphere for aviation interests.				*Budget*	
				FY05	0K*
Project Managers	*Centers*	*Timeframe*	*Partners*	FY06	115
John Murray--LaRC	LaRC (lead), GRC, ARC, MSFC	FY05-FY09	NOAA, FAA	FY07	215
				FY08	375
				FY09	375
Earth-Sun Science Products	AWDD combines a variety of Earth-Sun system products from a number of spacecraft including GOES, POES, Terra (MODIS), Aqua (MODIS) and AURA. Data from NPOESS and GOES-R will be emphasized. Data are also used from international spacecraft such as METEOSAT (ESA) and GMS (Japan).			*Other Apps.*	
Deliverables	Evaluation report, contact network, agreement/joint development plan, benchmark report, results conference(s)			N/A	

* AWDD activities in FY05 will be covered by contribution from Aeronautics Research Mission Directorate

Project: Weather Information System Enhancements (WISE)					
This project is part of the AvSSP Phase II plan. It is slated to begin in FY 06. Key objectives of the project are: (1) (ASAP) to improve aviation weather nowcast and forecast products through development and integration of spacecraft data algorithms with airborne observations; and (2) (WINGS) to develop active and passive sensor systems to reduce remaining airborne weather safety hazards.				*Budget*	
				FY05	----
Project Manager	*Centers*	*Timeframe*	*Partners*	FY06	150K
John Murray--LaRC	LaRC (lead), GRC, ARC, MSFC	FY06-FY09	FAA, NOAA	FY07	150
				FY08	150
				FY09	150
Earth-Sun Sciences Products	The Real-time Satellite Data Project combines a variety of Earth-Sun system science products from a number of spacecraft including GOES, POES, Terra (MODIS), and Aqua (MODIS). Data from GIFTS will also be utilized. Data are also used from international spacecraft such as METEOSAT (ESA) and GMS (Japan).			*Other Apps.*	
Deliverables	Evaluation report, contact network, agreement/joint development plan, benchmark report, results conference(s)			N / A	

B. Competitively Selected Programs

This Program Element participates in the "Decision Results through Earth Science Results" joint solicitation to be issued in FY05.

C. Congressionally Directed Activities

- Project: University of Alaska for Weather and Ocean Research
  - Center POC: Tom Stanley, SSC
  - FY05 Funding: $3M

D. Project Management

The Program Element plans to support symposiums, workshops, and committees, and the newly formed Aviation Working Group in FY05 with $50K, with funding staying level in FY06-09.

The Program Element collaborates and is a member of the following organizations. Other divisions of NASA support these organizations.

- The Joint Planning and Development Office (JPDO) Aviation Weather IPT
  - The JPDO Aviation Weather IPT is developing and implementing the National Aviation Weather Strategy.
  - NASA Points of Contact: Co-chair, Observations Working Group, John Murray (LaRC), NASA Aeronautics Research Mission Directorate Coordination Manager, Ron Colantonio, (GRC).

- The Aircraft Icing Research Alliance
  - NASA, the National Research Council of Canada, Transport Canada, and the Meteorological Service of Canada collaborate through this alliance on aircraft icing research to improve the safety of aircraft operations in icing conditions. The goal is to develop and implement an integrated icing research plan that balances short and long-term research needs. The alliance strengthens and fosters long-term aircraft icing expertise, exchanges technical and scientific information, encourages the development of critical aircraft icing technologies, and provides a framework for collaboration between alliance members.
  - NASA Point of Contact: Coordination Manager, Ron Colantonio (GRC)

- The OFCM Volcanic Ash Working Group
  - The OFCM is composed of several federal agencies including NASA, NOAA, FAA, USGS and DHS. The OFCM also includes academic partners such as MIT/LL. This office coordinates issues and programs dealing with meteorology and transportation throughout the federal government.
  - NASA Point of Contact: John Haynes

- United States Weather Research Program (USWRP)
  - The U.S. Weather Research Program coordinates research into more reliable and more focused forecasts to vulnerable regions and economic sectors. In a novel planning process, researchers, forecasters, and the users of forecast information identify the most relevant issues that have high potential for scientific progress. Through collaborative workshops, they lay out priorities, milestones, and resource needs and develop a fast track for scientific progress to transition into operational forecasting. Seven U.S. agencies currently support the USWRP: NOAA, the National Science Foundation (NSF), NASA, and the Departments of Defense (DOD), Transportation (DOT), Energy (DOE), and Agriculture (USDA).
  - NASA Point of Contact: Weather Theme Lead, Tsengndar Lee (HQ)

The Aviation Program Element also plans a joint venture with the Air Quality application in FY05 to evaluate aircraft emissions DSTs, if funding is available. This evaluation, if deemed appropriate to continue as a project, will proceed during FY 06-09.

The program element continues to fully support a web site located at the following address: http://www.earth.nasa.gov/eseapps/theme3.htm.

E. Additional Activities and Linkages

Science Mission Directorate Fellows:

1. Sonia Kreidenweis, "Laboratory Investigations of the Links Between Mineral Dust and Cloud Formation", Colorado State University
2. Bernard Engel, "Terrain Analysis and Surface Hydrologic Modeling Strategies Using High-Resolution Global Digital Topography", Purdue University

The Crosscutting Solutions Program—The program consists of functional elements that contribute to all of the National Applications activities. The intention is to have the performance of these functions leverage accomplishments, and therefore the apparent resource investment, to the greatest extent possible into the National Applications partnerships. These functions are: Geoscience Standards and Interoperability, Human Capital Development, Integrated Benchmark Systems, and Solutions Networks. Examples of leveraged activities are:

- *The Earth-Sun System Gateway* is a "portal of portals" providing an access point through an Internet interface to all web-enabled NASA research results.
- *A Rapid Prototyping Center* is a proposed center at Stennis to support NASA and partners in testing and verification of Earth science results in decision support tools.
- *Transition from Research to Operations Network (R2O)* is a network that focuses on systematically transitioning the results of research to operational uses.
- *DEVELOP* is a student-based program for rapidly prototyping solutions for state and local applications and helping students develop capabilities related to applied Earth-Sun science.

NASA and Science Mission Directorate Priorities

- *Federal Enterprise Architecture (FEA)* is a business and performance-based framework to support cross-agency collaboration, transformation, and government-wide improvement.
- *The Global Information Grid (GIG)* is the first stage of a U.S. military global, high-bandwidth, Internet protocol-based communications network (a.k.a., 'the Internet in space').
- *The Joint Center for Satellite Data Assimilation (JCSDA)* is a multi-agency collaboration to accelerate and improve the quantitative use of research and operational satellite data in weather and climate prediction models. NOAA (NESDIS, NWS, OAR), NASA, Navy, Air Force, and NSF (through UCAR) collaborate in JCSDA.
- *Metis* is a visual modeling software tool for planning, developing, and analyzing agencies' enterprise architectures. The Applied Sciences Program is using Metis to identify possible linkages between observations, models, and decision support tools to support the IWGEO and NASA/NOAA R2O activities.

- *Observing System Simulation Experiments (OSSEs)* use simulated observations to assess the impacts of future satellite instruments on weather and climate prediction and provide opportunities to test new designs and methodologies for data gathering and assimilation.
- *Project Columbia* is a NASA-wide project to develop a new, fast supercomputer (using an integrated cluster of interconnected processor systems) to support the Agency's mission and science goals, including enhanced predictions of weather, climate, and natural hazards.

VI. Budget: Fiscal Year 2005

The following table lists the Aviation Program budget (procurement) for FY2005:

Aviation	
Project	**FY05 Procurement Allocation ($K)**
ASAP:FAA AWRP Icing PDT	$365
ASAP:FAA AWRP Oceanic/Turbulence/Convective Wx PDT	$335
AWDD	$0
Program Management Activities	$50
Total	$750

Appendix C lists program-wide budget allocations for FY2005.

VII. Schedule and Milestones

The following listing includes schedule and milestone highlights from the goals listed in Section II and the Program Element roadmap (Appendix B) over the next few years:

FAA Icing Product Development Team (PDT)

- **September 2005:** NASA Current Icing Product (CIP) prototype (Icing Risk) Benchmark
- **September 2005:** Test and integrate improvements to operational CIP

FAA Convective PDT

- **May 2005:** Provide convective operational data sets

FAA Oceanic Weather PDT

- **December 2004:** Cloud top height validation and evaluation report
- **May 2005:** Evaluation report on Volcanic ash testing
- **June 2005:** Convective Initiation Fields developed for Oceanic Convective Weather Forecast

FAA Turbulence PDT

- **December 2006:** Graphical Turbulence Guidance -- Aviation Weather Technology Transfer D3

VIII. Performance Measures

The Aviation Management Team uses performance measures to track progress, identify issues, evaluate projects, make adjustments, and establish results of the Program Element. The Aviation Program Element's Goals and Objectives (Section II) state what the Program Element intends to achieve. These measures help monitor progress within and across specific activities to ensure the Program meets its goals and objectives.[1] The management team analyzes these measures retrospectively in order to made adjustments proscriptively to the program approach and objectives.

The measures are in two categories: Program Management measures are internally focused to assess the activities within the program. Performance measures are externally focused to assess whether the Program activities are serving their intended purpose. In general, the Aviation Program Element uses these measures to evaluate the performance of activities conducted and sponsored by the program, especially the projects. In addition, the Applied Sciences Program uses this information in preparing IBPD directions and PART responses.

[1] *These measures are like gauges in an automobile - they serve as indicators to help the management team track conditions and identify issues in order to keep the program aligned with the plan & meet objectives.*

Program Management Measures (Internal):

Inputs	Potential issues and DSTs identified for Aviation – *number, type, range* Eligible partners to collaborate with – *number, type, range* Potential results/products identified to serve Aviation – *number, type, range*
Outputs	Assessments or evaluations of DSTs – *number, range* Assessments of Earth-Sun science results/products to serve DSTs – *number, range* Agreements with partners – *presence* Reports (evaluation, validation, benchmark) – *number, type*
Quality & Efficiency	Earth-Sun science results/products – *number used per DST, ratio of utilized to potential* Agreements – *ratio of agreements to committed partners* Reports – *partner satisfaction, timeliness, time to develop* Reports – *ratio of validations to potential products, ratio of benchmarks to validations*

Performance and Results Measures (External):

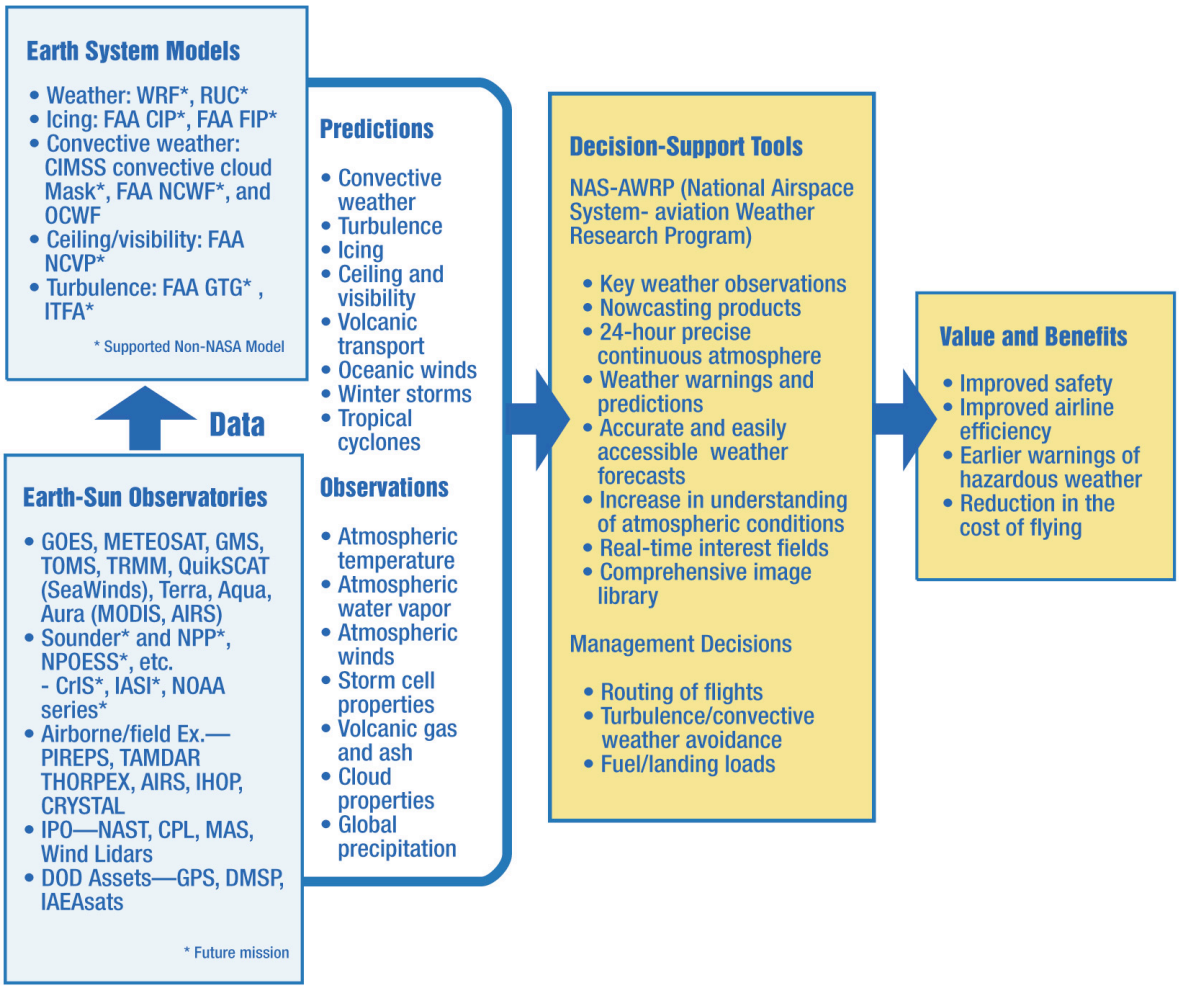
Outcomes	Earth-Sun science products adopted in DSTs – *number, type, range; use in DST over time* Earth-Sun science products in use – *ratio of products used by partners to reports produced* Partner and DST performance – *change in partner DST performance, number & type of public recognition of use & value of Earth-Sun science data in DST*
Impacts	Partner value – *change in partner metrics (improvements in value of partner decisions)*

In addition to the stated measures, Aviation Program Management periodically requests an assessment of its plans, goals, priorities, and activities through external review. The Aviation Team uses these measures along with comparisons to programmatic benchmarks to support assessments of the Applied Sciences Program (e.g. internal NASA reviews and OMB PART). Specifically, the Aviation Program Element uses comparisons to similar activities in the following programs (i.e., program benchmarks) to evaluate its progress and achievements:

- Environmental and Societal Impacts Group at NCAR
- Global Monitoring for Environment and Security (GMES)

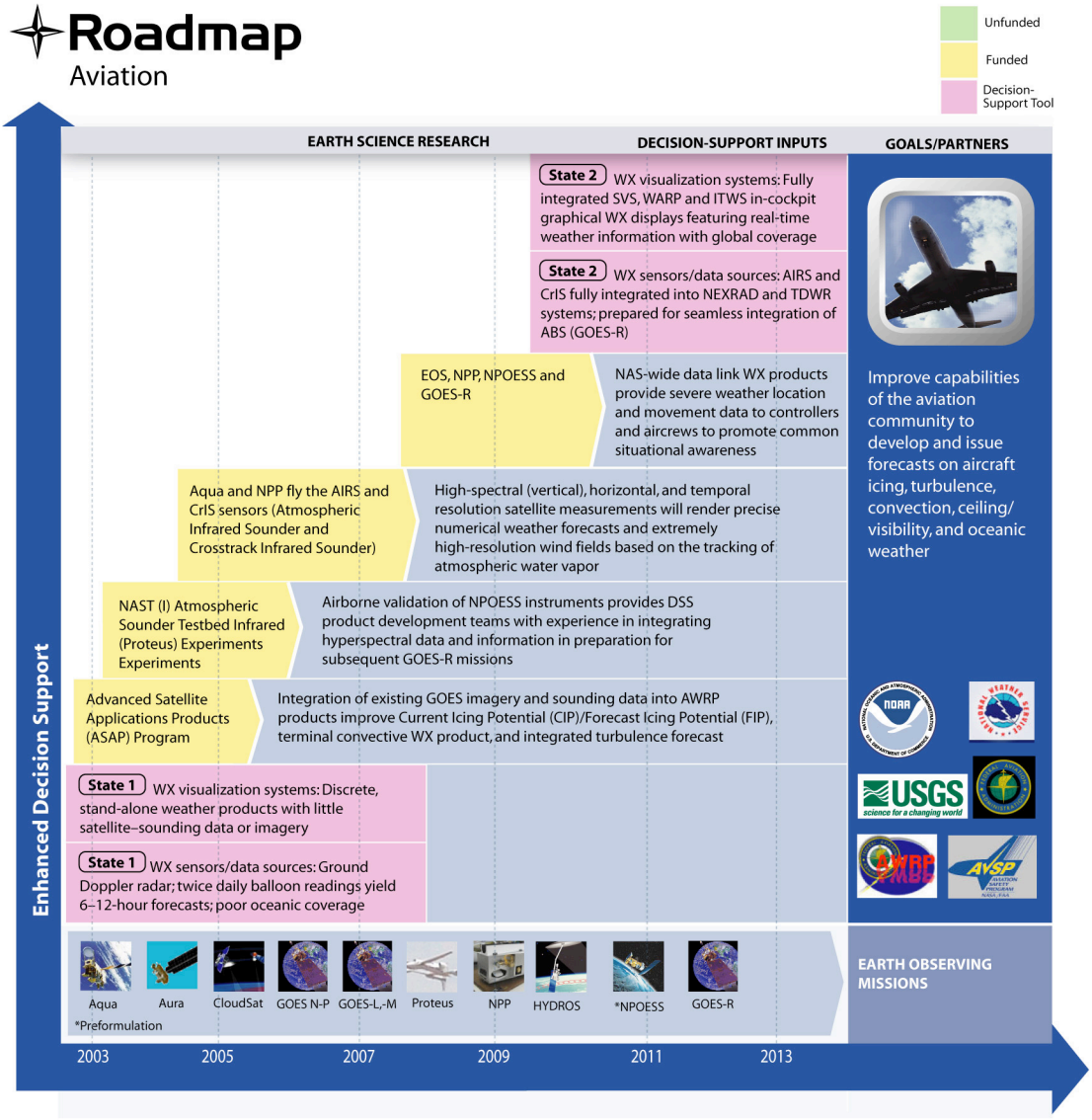
IX. Appendices

Appendix A. Integrated System Solution Diagram



Appendix B. Roadmap

The following roadmap shows the direction of the program over the next ten years. It illustrates the current state of Aviation DSTs and the projected state of those DSTs with the infusion of NASA Earth-Sun system science research results. The Aviation program plan deals in detail with the first five years of the roadmap.



Appendix C. Applied Sciences Program Budget FY2005

The overall program budget allocations are given below to provide the context in which this National Application is conducted. The allocations are based on Agency and program priorities and are subject to change according to the availability of funds and programmatic strategies. All values are in $ thousands.

*NOTE: Allocations include full utilization of the Applied Sciences FY04 carryover of approximately $2.7 million.

Table 1: Applied Sciences Procurement Allocation – FY05

Program Element	FY05 Procurement Allocation
National Applications	
Agricultural Efficiency	$ 467
Air Quality Management	$ 995
Aviation	$ 750
Carbon Management	$ 653
Coastal Management	$ 550
Disaster Management	$ 545
SENH	$ 1,429
Ecological Forecasting	$ 610
Energy Management	$ 775
Homeland Security	$ 205
Invasive Species	$ 205
Public Health	$ 725
Water Management	$ 870
Program Director Discretionary Fund	$ 588
Center Director Discretionary Fund Tax	$ 2,485
National Applications Total	$ 11,852
Crosscutting Solutions	
Integrated Benchmarked Systems	$ 3,529
Solutions Networks	$ 1,200
Competitive Solicitations	$ 7,600
Human Capital Development	$ 700
Geoscience Standards & Interoperability	$ 2,000
Crosscutting Solutions Total	$ 15,029
Applied Sciences Program Procurement Total	***$ 26,881***

Table 2: Applied Sciences Program NASA Institutional Allocations – FY05

NASA Center	FY05 Institutional Cost / National Applications	FY05 Institutional Cost / Crosscutting Solutions	Institutional Total
HQ	$3,773	$7,351	$11,124
ARC	$1,108		$1,108
GSFC	$1,009	$1,094	$2,103
JPL			
LaRC	$1,517	$444	$1,961
MSFC	$1,251	$183	$1,434
SSC	$3,194	$8,689	$11,883
Total	***$11,852***	***$17,761***	***$29,613***

Appendix D. Extended Information on Partners

Federal, State and Academic Partners:

(1) FAA Aviation Weather Research Program. The President's budget for the FAA contains specific authority for the conduct of aviation weather research. The FAA Aviation Weather Research Program (Code AUA-430) conducts this research. The FAA AWRP, as the FAA's primary weather product development activity, develops nowcasting products for various aviation weather hazards that are produced operationally by the Aviation Weather Center of the NOAA/NWS National Centers for Environmental Prediction (NCEP). The FAA AWRP is a partner with NASA in the Aviation Safety and Security Program (AvSSP). The Applied Sciences sponsors AvSSP research to infuse spacecraft observations and related technologies into the FAA AWRP. POC: Gloria Kulesa.

(2) Office of the Federal Coordinator for Meteorology (OFCM). The OFCM has overall responsibility for coordinating national objectives for meteorology between various federal agencies. These agencies include NASA, NOAA, the USGS, and the FAA with respect to aviation weather requirements. POC: Mary Cairns.

(3) Joint Planning and Development Office (JPDO). The JPDO, working in close collaboration with the Departments of Transportation, Commerce, Defense, and Homeland Security, NASA and the Office of Science and Technology Policy and other experts from the public and private sectors, the JPDO will develop a National Plan for the Next Generation Air Transportation System. The JPDO will ensure that planning and execution of the plan are coordinated across government and industry.

(4) FAA Operations. FAA spacecraft data requirements are also coordinated with FAA Operations. The Applied Sciences program is an active participant with the FAA in various activities for the OFCM, including membership in the OFCM Volcanic Ash Working Group that is chaired by a representative of FAA Operations. POC: Rick Heuwinkel (FAA ARS-100); OFCM Volcanic Ash Working Group Chairman, Steve Albersheim (FAA ARS-100).

(5) NOAA/NWS Office of Science and Technology. The NOAA OS&T Aviation Weather Branch is a member of the OFCM JPO and is actively involved in providing liaison between the FAA AWRP, NASA AvSSP and NOAA. POC: Kevin Johnston.

(6) NOAA/NWS NCEP Aviation Weather Center (AWC). The Aviation Weather Center produces a variety of aviation weather information. In addition to nowcasting products produced by the FAA AWRP, the Aviation Weather Center also runs the hourly Rapid Update Cycle (RUC) Model over CONUS and administers the Automated Digital Data Server (ADDS), both which were developed by the FAA AWRP. The AWC assists the FAA AWRP in the independent validation, verification and certification of FAA AWRP products as a member of the Aviation Weather Technology Transfer (AWTT) board. POC: Fred Mosher; Director, Jack May.

(7) FAA Technical Center. The FAA Tech Center has primary responsibility for testing and evaluating FAA operational procedures, systems and products. They provide preliminary evaluation of FAA AWRP products and also serve on the AWTT board. POC: Danny Sims.

(8) NOAA National Environmental Satellite Data Information Service (NESDIS).
The NOAA Volcanic Ash Advisory Center (VAAC), under the auspices of NOAA NESDIS and NCEP, is responsible for monitoring all available satellite imagery for volcanic ash plumes and issuing Volcanic Ash Advisories (VAA). The National Centers for Environmental Prediction is responsible for issuing Volcanic Ash Forecast Transport and Dispersion (VAFTAD) Models, which are used in the production of VAAs. Data from the Total Ozone Mapping Spectrometer (TOMS) satellite and the Moderate Resolution Imaging Spectroradiometer (MODIS) onboard the Terra and Aqua Earth-observing research satellites are actively used by the VAAC in the monitoring of volcanic activity. NASA-built sensors on NOAA's Geostationary Operational Environmental Satellites (GOES) and Polar Operational Environmental Satellites (POES) also support the VAAC in fulfilling its mission. POC: Director, Gloria Swanson.

(9) NOAA/U. of Wisconsin Cooperative Institute for Meteorological Satellite Studies (CIMSS). UW CIMSS is a leading weather satellite research activity and it is currently a primary research partner in NASA Applied Sciences Program Aviation applications. POC: Director, Dr. Hank Revercomb.

(10) NOAA Forecast Systems Laboratory (FSL). NOAA FSL is NOAA's primary model development activity. They are also a key collaborator with the FAA AWRP's Model Development and Enhancement Team, which developed the RUC model. The FSL is also the lead activity in developing the Weather Forecasting and Research Model (WRF) and is expected to collaborate extensively with the Aviation Applications Program to incorporate spacecraft observations into modeling activities associated with aviation weather applications. POC: Stan Benjamin.

(11) National Center for Atmospheric Research (NCAR) Research Applications Program (RAP). NCAR RAP is the single largest research activity supporting the FAA AWRP. The Applied Sciences Program's Aviation Applications Program supports NASA and NOAA observational spacecraft data integration research at NCAR RAP to enhance FAA AWRP products. POC: Bruce Carmichael and David Johnson.

(12) MIT Lincoln Laboratory (LL). MIT LL is a participating research laboratory in the FAA AWRP. Satellite applications research at MIT LL is also supported by the Aviation Applications Program to assist the FAA AWRP to incorporate NASA, DOD, and other satellite data into AWRP products. POC: Mark Weber.

(13) National Institute of Aerospace (NIA). The NIA is a NASA-funded consortium of leading universities who are conducting cutting edge research in science and engineering. POC: Bill Grose.

(14) United States Weather Research Program (USWRP). The USWRP is a partnership among several governmental agencies–NOAA, NASA, DOE, DOT, USDA, the American

Meteorological Society, the National Science Foundation (NSF), and the U.S. Navy–and the academic and commercial communities. USWRP programs are implemented through a series of highly focused projects that were selected based on advice from members of the scientific and user communities. The program's initial scientific foci for FY 2000-2006 are landfalling hurricanes; heavy precipitation and flooding, focusing on the optimal use of data and improved numerical precipitation guidance; societal and economic impacts.

(15) Aerospace States Association (ASA). The Aerospace States Association (ASA) is the nation's premier aerospace advocacy organization representing states. ASA focuses on national aviation and space policy development, economic advancement, scientific enrichment, and academic excellence. Membership in ASA is open to all U. S. states and territories with forty-four states currently members of ASA. Each state is represented by a governor-appointed delegate who heads the states' delegation, which is composed of alternate delegates representing state agencies, commissions, organizations and other key aerospace leaders. In many states, the Lieutenant Governor serves as the state's delegate to ASA. State ASA delegations collectively promote the unique interests of the states in federal aerospace policy formulation and implementation.

(16) Western Governors Association (WGA). The WGA addresses important policy and governance issues in the West, advances the role of the Western states in the federal system, and strengthens the social and economic fabric of the region. WGA develops policy and carries out programs in the areas of natural resources, the environment, human services, economic development, international relations and state governance. WGA acts as a center of innovation and promotes shared development of solutions to regional problems

(17) National States Geographic Information Council (NSGIC). The National States Geographic Information Council (NSGIC) is an organization of States committed to efficient and effective government through the prudent adoption of geospatial information technologies. Members of NSGIC include delegations of senior state geographic information system managers from across the United States. Other members include representatives from federal agencies, local government, the private sector, academia and other professional organizations. A rich and diverse group, the NSGIC membership includes nationally and internationally recognized experts in geographic information systems (GIS), geospatial data production and management, and information technology policy.

(18) GLOBE. GLOBE is a worldwide hands-on, primary and secondary school-based education and science program designed to improve skills and inspire children in the areas of mathematics and science.

International Partners:

(1) National Research Council (NRC) Canada, Meteorological Service Canada (MSC) and the Canadian Weather Research Program (CWRP). ASAP collaborates with the NRC and MSC personnel through the CWRP in both THORPEX and Alliance Icing Research Study (AIRS) campaigns. AIRS is the field research arm of the Aircraft Icing Research Alliance between NASA and the NRC. POC: Director (CWRP), Jim Abraham.

(2) Radio Technical Commission for Aeronautics (RTCA). RTCA, Inc. is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management (CNS/ATM) system issues. RTCA functions as a Federal Advisory Committee. Its recommendations are used by the Federal Aviation Administration (FAA) as the basis for policy, program, and regulatory decisions and by the private sector as the basis for development, investment and other business decisions. Organized in 1935 as the Radio Technical Commission for Aeronautics, RTCA today includes roughly 250 government, industry and academic organizations from the United States and around the world.

(3) International Civil Aviation Organization (ICAO). ICAO is the international governing body for civil aviation under the auspices of the United Nations.

Appendix E. Acronyms and Websites

ACRONYMS:

ADDS	Automated Digital Data Server
ADDS	Aviation Digital Data Service
AIRS	Alliance Icing Research Study
ARC	Ames Research Center
ASA	Aerospace States Association
ASAP	Advanced Satellite Aviation-weather Products
ATM	Air Traffic Management
AVHRR	Advanced Very High Resolution Radiometer
AvSSP	Aviation Safety and Security Program
AWC	Aviation Weather Center
AWDD	Aviation Weather Digital Database
AWIN	Aviation Weather Information
AWIPS	Advanced Weather Interactive Processing System
AWRP	Aviation Weather Research Program
AWTT	Aviation Weather Technology Transfer
CCSP	Climate Change Science Program
CCTP	Climate Change Technology Program
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CIP	Current Icing Product
CNS	Canadian Nuclear Society
CONUS	Coverage of Continental United States
COTR	Contracting Officer's Technical Representative
CrIS	Cross-track Infrared Sounder
CWRP	Canadian Weather Research Program
DAAC	Distributed Active Archive Center (Data Active Archive Center)
DHS	Department of Homeland Security
DOC	US Department of Commerce
DOD	US Department of Defense
DOE	US Department of Energy
DOT	US Department of Transportation
DSS	Decision Support Systems
DST	Decision Support Tool
ESA	Earth Science Applications
FAA	Federal Aviation Administration
FEA	Federal Enterprise Architecture
FIP	Forecast Icing Potential
FSL	Forecast Systems Laboratory
FY	Fiscal Year
GIFTS	Geosynchronous Imaging Fourier Transform Spectrometer
GIG	Global Information Grid
GIS	Geographic Information System
GLOBE	Global Learning and Observations to Benefit the Environment
GMS	Ground Water Modeling System
GOES	Geostationary Operational Environmental Satellite
GRC	Glenn Research Center
GTG	Graphical Turbulence Guidance

IBPD	Integrated Budget and Performance Document
ICAO	International Civil Aviation Organization
IPT	Integrated Product Team
IWGEO	Interagency Working Group on Earth Observations
JCSDA	Joint Center for Satellite Data Assimilation
JPDO	Joint Planning and Development Office
LaRC	Langley Research Center
LL	Lincoln Laboratory
METEOSAT	European Meteorological Satellite
MIT	Massachusetts Institute of Technology
MODIS	Moderate Resolution Imaging Spectroradiometer
MSC	Meteorological Service Canada
MSFC	Marshall Space Flight Center
NAS	National Airspace System
NASA HQ	NASA Headquarters
NASA	National Aeronautics and Space Administration
NAST	NPOESS Airborne Sounder Test-bed
NCAR	National Center for Atmospheric Research
NCEP	National Centers for Environmental Prediction
NCWF	National Convective Weather Forecast
NESDIS	National Environmental Satellite Data Information Service
NIA	National Institute of Aerospace
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-Orbiting Operational Environmental Satellite System
NPP	NPOESS Preparatory Project/Net Primary Productivity
NRC	National Research Council
NSF	National Science Foundation
NSGIC	National States Geographic Information Council
NWS	National Weather Service
OAR	Office of Oceanic and Atmospheric Research
OFCM	Office of the Federal Coordinator for Meteorology
OMB	Office of Management and Budget
OS&T	Office of Science and Technology
OSSE	Observing System Simulation Experiment
OSTP	Office of Science and Technology Policy
PART	Program Assessment Rating Tool
PDT	Product Development Team
POC	Point of Contact
POES	Polar Orbiting Environmental Satellites
QuikSCAT	Quick Scatterometer
R2O	Research to Operations Network
RAP	Research Applications Program
RTCA	Radio Technical Commission for Aeronautics
RUC	Rapid Update Cycle
SEA	State Enterprise Architecture
S-HIS	Scanning Hyperspectral Infrared Sounder
SSC	Stennis Space Center
TERRA	Not an Acronym
THORPEX	The Observing-System Research and Predictability Experiment
TOMS	Total Ozone Mapping Spectrometer
TRMM	Tropical Rainfall Measurement Mission

UCAR	University Corporation for Atmospheric Research
USDA	US Department of Agriculture
USGS	United States Geological Survey
USWRP	United States Weather Research Program
UW	University of Wisconsin
VAA	Volcanic Ash Advisories
VAAC	Volcanic Ash Advisory Center
VAFTAD	Volcanic Ash Forecast Transport and Dispersion
WGA	Western Governors' Association
WINGS	Weather Information Next-Generation Sensors
WISE	Weather Information System Enhancements
WMO	World Meteorological Organization
WRF	Weather Research and Forecast
WWRP	World Weather Research Program

WEBSITES:

ADDS: http://adds.aviationweather.noaa.gov

ADDS Convection: http://adds.aviationweather.gov/convection/

ADDS Turbulence: http://adds.aviationweather.gov/turbulence/

Advanced Air Transportation Technologies DSTs: http://www.asc.nasa.gov/aatt/dst.html

Applied Sciences Program Aviation Program Element: http://www.earth.nasa.gov/eseapps/theme3.htm

AWC: http://www.aviationweather.gov

AWRP: http://www.faa.gov/aua/awr/

CIP: http://aviationweather.gov/exp/cip

FIP: http://aviationweather.gov/exp/fip

JPDO: http://www.jpdo.aero

NWS Office of Science and Technology: http://nws.noaa.gov/ost

OFCM: http://www.ofcm.gov

RUC Maps: http://maps.fsl.noaa.gov

VAFTAD: http://www.ssd.noaa.gov/VAAC/volc_img.html

WRF: http://wrf-model.org/

AIWG: http://aiwg.gsfc.nasa.gov/

Applied Sciences Program: http://science.hq.nasa.gov/earth-sun/applications

DEVELOP: http://develop.larc.nasa.gov

Earth-Sun System Gateway (ESG): http://esg.gsfc.nasa.gov/

Earth-Sun Science System Components: http://www.asd.ssc.nasa.gov/m2m

NASA FY2005 Budget: http://www.ifmp.nasa.gov/codeb/budget2005

Research and Analysis Program: http://science.hq.nasa.gov/earth-sun/science/

Science Mission Directorate: http://science.hq.nasa.gov

Science Strategies: http://science.hq.nasa.gov/strategy/